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The Planning-Programing-Budgeting System (PPBS) uses techniques of systems analysis, cost-benefit analysis, and program budgeting in the administration of large, complex organizations. Some university administrators hope to improve their institutions' internal management through the PPBS approach. The basic program categories of the university are its functions --instruction, research, and public service. In detailed program planning, these categories would subdivide into program elements, or academic disciplines. Program activity units would be organized courses, and these in turn could subdivide into undergraduate, graduate, faculty and postdoctoral levels. The program planning process would then begin with the projection of program loads --such as student enrollment loads-- which flow into the annual academic and budget preparation cycle. Analysis and evaluation of the program would follow. Research library programs provide services, materials, and facilities in response to demands created by students and faculty. The resource requirements for the library's program elements can be predicted from data which describe the composition and quantities of demand for library services that are generated by the university's program categories. The interlocking of research library and university functions suggests that library planning would be an effective first step toward comprehensive university planning. (WM)

MASON, THOMAS R.

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PROGRAM PLANNING FOR RESEARCH LIBRARIES IN A UNIVERSITY SETTING

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A paper prepared for presentation to the Association of Research Libraries, January 26, 1969, Washington, D. C.

The most remarkable contemporary product of administrative science is a movement commonly represented by the initials, PPBS, which stand for "Planning-Programming-Budgeting System." I call it a movement because PPBS comprehends a diverse and not altogether coherent body of concepts, approaches, and methods. As made famous by the apparently successful application in the Department of Defense under Robert S. McNamara, PPBS involves the use of the techniques of systems analysis, cost-benefit analysis, and program budgeting in the administration of large and complex organizations.[1]

Since the presidential order of August, 1965 that directed all federal agencies to institute the PPBS approach, it has swept through the nation. State and local governments, all kinds of institutional organizations, and the business world are experimenting with PPBS concepts and methods. As is so often the case when a set of ideas takes on the missionary character of a reform movement, a great deal of confusion and not a little nonsense is being generated in the process. Nevertheless, the central ideas in the approach are potentially powerful weapons in the continuing struggle to control, direct, and sustain our modern organizational Leviathans.

Institutions of higher education, in the face of increasingly massive scale and complexity, are among those that are searching the PPBS approach for ways of improving their internal management. It is at least symbolically significant that the man primarily credited with the development of PPBS in the Defense Department, Charles J. Hitch, is now president of the original multiversity, the University of California.

In addition to the attractions of PPBS concepts for improving internal administration of colleges and universities, federal agencies, state governments, and even the private foundations are expecting justification of higher education resource needs in the language of program budgeting and cost-benefit analysis.

The question is, What is it? And How can it best be applied to universities and ~~the~~ their components? So far, no one has fully agreed upon a satisfactory delineation of the appropriate programs of higher education. Furthermore, the outputs of the knowledge industry are so often intangible and unmeasurable in terms of either costs or benefits, we cannot expect to treat them as we may reclamation projects, weapons systems, or manufacturing processes. We can, however, do a great deal to strengthen the justification and management of the resources of higher education by the more coherent ~~and~~

and systematic program planning and analysis called for in the Planning-Programming-Budgeting approach.

I should like to explore with you an approach to program planning for the research library in a university setting. I hasten to disclaim expertise in library administration, but since I have been involved in various facets of university planning over the past 14 years I have had frequent exposure to the problems of relating university planning and budgeting to library planning and budgeting. I believe that the basic purposes of the research library are so interlocked with the purposes and functions of the university that the program objectives are closely correlated. The categories of programs and resources applied to the research library, with appropriate refinement to account for its specialized tasks, can be articulated with those applied to the university as a whole.

When we are looking at the university as a system, we generally view the research library as a resource supporting the instruction, research, and public service functions of the university. When we focus on the library as a subsystem, its programs are to provide bibliographic materials and user services. The planning process for the research library involves projecting the demand for materials and services and estimating the resources -- the personnel, building facilities, equipment, and money -- that will be required to meet the projected demand. Administrative programming involves organizing the library processes and activities to carry out the program. The program budgeting process is the allocation of resources and control of their use to get the most out of them in meeting program objectives. For the sake of simplicity, I shall refer loosely to all of these processes as "program planning." Another word for it, I might note, is "administration."

I shall try to make these general ideas more concrete by illustrating the main categories of program structure of a university and then by relating these to the programs, operations, organization, and resources of the research library.

1. The Program Structure of Universities

a. Basic Programs

The basic functions of universities are traditionally defined as instruction, research and public service. So far, the majority of efforts to institute program budgeting are using these classical functions as the basic program categories.[2] While they are not fully satisfactory for program planning purposes because they are so broad and operationally overlapping, instruction, research, and public service are reasonably definable general classes of program activity; but they need to be subdivided along several dimensions.

The committee that formulated the proposal for a comprehensive higher education management information system for the Western Interstate Commission for Higher Education, recently funded by the Office of Education, used these three classical categories for illustrative input-output program models.[3] The Student Instruction Model views the student flowing in, passing through the instruction program supported by resource inputs, and the student flowing out. In the process, the student has experienced a change of state which should be measured to assess the output and performance of the instruction

program. The Research Model conceives of current knowledge as input and revised or new knowledge from research findings as output of the research program. The public service program is similarly modeled. The resource inputs to each model are faculty and supporting staff, physical facilities, supplies and equipment, libraries and other academic services, and the other two major programs. In other words, research and public service programs are viewed as resource inputs to instruction.

b. Program Elements

In order to bring these broad program categories down to a more concrete level for detailed program planning, they must be subdivided into specific program elements which reflect different dimensions of the program of a particular institution. It is the combination of these program elements in various mixes that forms the content of the major programs. I believe that the program elements are best represented by groups of faculty members and supporting staff defined in terms of academic and professional disciplines. Members of the faculty are program resources, but their knowledge of their disciplines forms the content of the major programs of instruction, research, and public service. (See Figure A.)

For practical purposes, it probably is necessary to categorize the academic discipline program elements by organizational units, the academic departments grouped into colleges and professional schools. The study of program budgeting prepared for the American Council on Education suggested using core academic departments as the appropriate program elements.[4] Charles Hitch believes this is unsatisfactory, especially for the multi-campus university, because "Departments are rather arbitrary divisions, differing widely from campus to campus and changing in structure frequently on any given campus."[5] He also notes that some universities, such as Oxford, Cambridge, and the Santa Cruz campus, are not organized on departmental lines. I believe that for long-range program planning purposes in a university we must describe programs in terms of basic academic and professional disciplines. But budgets must be allocated to viable organizational units, whether these are discipline-based departments or multi-disciplinary residential colleges. The contributions of these units to the major program activities of the university, in any case, define the real content of the programs.

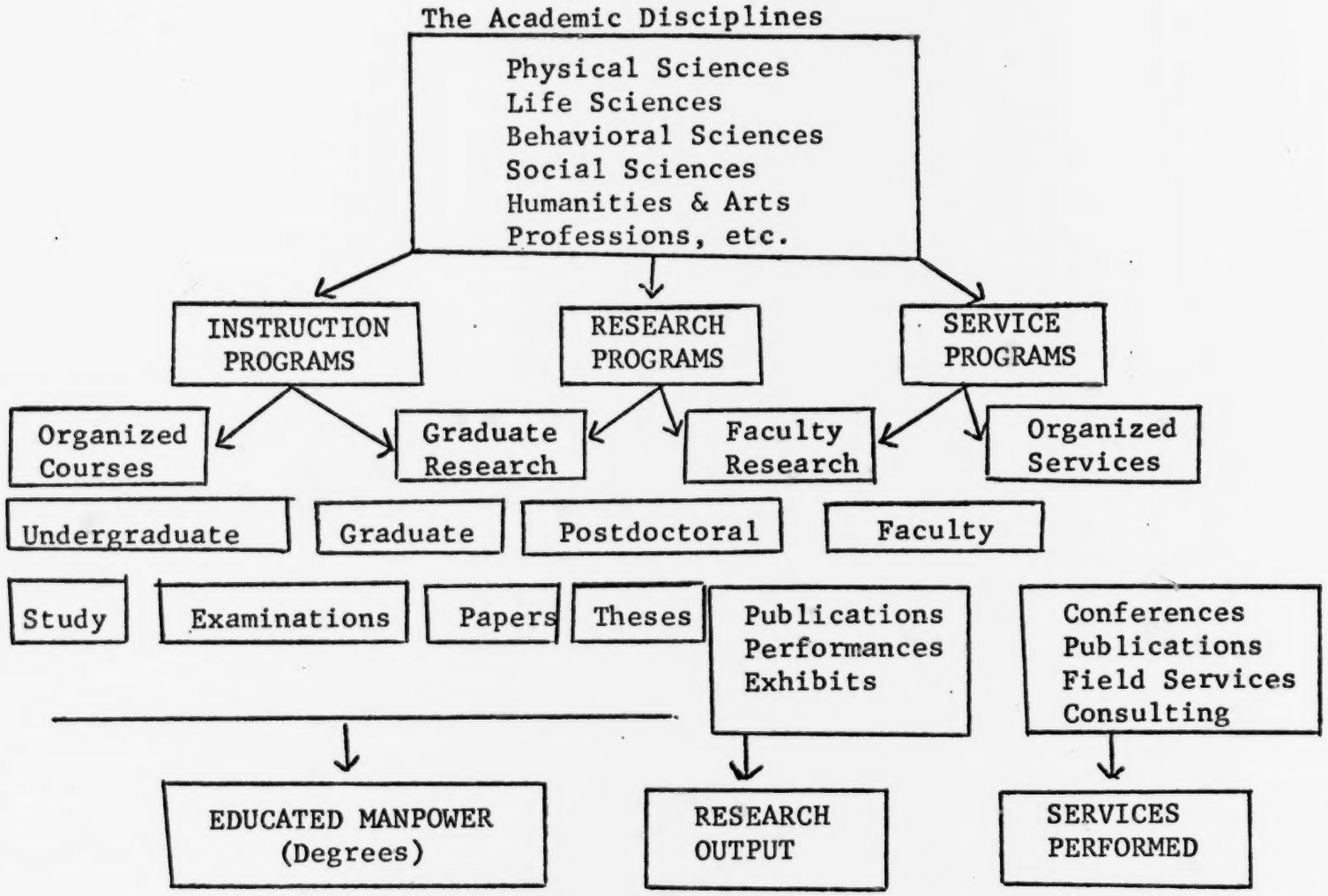
For example, the instruction program is organized primarily (but not exclusively) around degree programs. The degree programs are structured by requirements which the student must satisfy to achieve the seal of the institution on a diploma. To fulfill both the prescribed and elective requirements, the student must draw upon the offerings of several academic or professional disciplines--many different ones in undergraduate programs and at least two or three in most graduate programs.

c. Program Activities

This brings us to the next dimension that we must define for university program planning: I shall call it the Activity Unit. Programs are composed of both organized and informal activities of people carrying out the purposes and objectives of the program. In the instructional program, the bulk of this activity is centered around organized courses offered by the various departments and schools. The content of these courses is determined

FIGURE A

A PROGRAM STRUCTURE OF A UNIVERSITY



SUPPORT PROGRAMS

General Administration
General Services
Student Services

Library

Museum

Physical Plant

Auxiliary Enterprises
- Housing
- Food Services
- Bookstores, etc.

Organized Activities
- Athletics
- Laboratory Schools
- Student Activities

Categories

Program Elements

Basic Programs

Program Activities

Program Levels

Activity Outputs

Program Outputs

RESOURCES
- Faculty
- Supporting Staff
- Supplies & Expense
- Equipment
- Building Facilities
- Student Aid

by the academic or professional discipline and the nature of the specialization of the individual faculty member.

The structure of the particular activity determines its load capacity. For example, a course is a unit of activity structured by pedagogical method that determines its enrollment size, the types of space, equipment, and fixtures needed to carry out the activity, and the amount of student, faculty, and facilities time the activity consumes. When the enrollment demand load exceeds the capacity of a unit of activity, another unit of activity must be set up, requiring additional resources.

d. Program Levels

Another dimension that must be defined into categories in university program planning is the level of the program activity. We all recognize the difference between undergraduate and graduate programs in terms of content and cost. These may be further subdivided into lower division and upper division undergraduate; beginning and advanced graduate levels. Postgraduate and faculty levels also must be defined. Like differing mixes of academic discipline elements, differing mixes of program content by level have a major impact on resource requirements.

e. Program Load Projections

Having defined the categories of program elements (disciplines), program activities, and program levels by appropriate classification, the program planning process goes into action. The projection of program loads to some planning target in relation to the anticipated program structure is by no means a simple task, for not only are we trying to anticipate future developments clouded with unknowns, but we may have to start with a set of moving targets that haven't had the bull's-eye drawn on them yet. Furthermore, we often have relatively little historical data available from which to construct reasonable projection factors.

At the present time in university planning, most of us start by projecting student enrollment loads toward some expected future target level. At the University of Colorado we now have an excellent computer program that takes student enrollment projections by level of student, sex, and in-state or out-state residency, and predicts the expected distribution of majors, course enrollments, and student credit hours by subject field and level. The initial projections are based on current distribution patterns. We then project the instructional faculty requirements according to expected (or current) teaching loads in each field and level. These projections flow into the annual academic planning and budget preparation cycle. There, we try to feed in the program changes that may be expected to change the projection outcomes and assess the costs of these program changes. From these revised projections, we will build the estimates of the resources required to accomplish the projected programs in terms of personnel, building space, and operating costs.

f. Program Analysis and Evaluation

Making projections is only a beginning, and the projections alone do not make a plan until they have been thoroughly exercised and revised in the process of defining policy goals and objectives. In a university this exercising may be a long and difficult process, for the decentralized

decision-making structure of the academic community does not permit the degree of central control over policy-formation found in a more hierarchically-structured organization. In any case, goals and objectives are what people disagree about and fight over.

In many respects, the PPBS approach is an attempt to overcome this problem. First, it attempts to use quantitative analysis wherever possible so that quarrels over numbers are minimized. Secondly, by focusing more control over programs in the process of resource allocation or budgeting, it tends to increase the ability of administrators who control the distribution of funds to influence program development. Finally, through systems analysis and cost-benefit analysis, the PPBS approach seeks to improve the rationality, especially the economic rationality, of the process of defining and selecting program goals and objectives. I don't think I need to point out the potential dangers of this approach. Its major value, however, is that it organizes our thinking about where we are going more coherently and permits us to do a better job of assessing the costs and consequences of our decisions.

It is in the process of program analysis and evaluation that the sharpening of goals and objectives takes place. In the PPBS approach systems analysis is the instrument by which mere projections are reshaped into program plans. Let me quote a concise description of a systems analyst (as the title is used in PPBS) given by one commentator:[6]

> The good systems analyst is a"chochem" a Yiddish word meaning "wise man", with overtones of "wise guy." His forte is creativity. Although he sometimes relates means to ends and fits ends to match means, he ordinarily eschews such pat processes, preferring instead to relate elements imaginatively into new systems that create their own means and ends. He plays new objectives continuously against cost elements until a creative synthesis has been achieved. He looks down upon those who say that they take objectives as given, knowing full well that the apparent solidity of the objective will dissipate during analysis and that, in any case, most people do not know what they want because they do not know what they can get.

This description emphasizes the fact that planning (which I consider systems analysis to be) is not a cut-and-dried, step-by-step process, but it is a highly heuristic, intuitive, and pragmatic art. It is a kind of skill that any modern administrator must have.

For analysis and evaluation, we try to create quantitative and logical models of the enterprise, or segments of it, in which we try to discover the interrelationships between program load distributions, program activity structures, and the various kinds of resources required. Manipulating the factors representing various policies and objectives, the analyst tries to assess the effects of various kinds of changes on other parts of the system and on estimated costs. Evaluation is largely a judgmental process, for in most cases the "benefits" or qualities being juxtaposed against cost are not measurable. From analysis and evaluation emerges a set of recommendations about what ought to be done and what courses of action (programming) seem most appropriate to carry out the proposed program plan.

g. Budgeting

Charles Hitch has stated that

> The function of the program budget is to link the substantive planning of the organization with its fiscal planning, and its long-range planning with its annual budget. It is both a long-range plan and a multi-year budget. It projects, as far as is necessary or desirable, all the resource and money requirements to carry out the programs of the organization. By linking substantive and fiscal planning it keeps the substantive planning feasible and balanced.[7]

As yet, no one has really devised a satisfactory program budgeting system for a university. (For that matter, it is not at all clear that there is such a thing as a program budget in the Department of Defense as conceptualized in the Rand Corporation studies.)[8] The concepts are still, and may remain, more a mode of thinking than a budgetary system. I do think that as program planning is developed over time it will bring changes in the organization and structure of budgets that will more nearly approximate the ideal of linking expenditures to programs.

Program planning can have more immediate payoffs in relation to budgeting. There are two elementary aspects to budgeting: (1) getting the money, and (2) spending it. Many of the commentators on program budgeting seem to imply that the budget pie is a given and the task of budgeting is to divide it up to achieve optimum efficiency and effectiveness in program outputs with the given resources.

The first value of effective program planning, I think, is to make a convincing case of need to those who supply the resources, in other words, to sell the plan. The resource providers, one may expect, will apply their own systems analysis to prove (at least to themselves) that you can do more for less money than you are asking, so you must be prepared with effective data and analysis to make a convincing case of both the desirability of your program goals and the necessity of the resources to fulfill them.

Once the allocations of either operating or building dollars are made from on high -- always less than you need because there is never enough to go around -- the main task of budget-making seems to be to decide what not to do that you had hoped to do. Program planning should yield a clearer sense of priorities and timing to help decide what can be deferred or omitted and the consequences of the deletion.

If the program planning is reasonably coherent, the budgeting process -- even within the traditional categories of function and object of expenditure -- can proceed with much greater intelligence and effectiveness.

2. A Program Planning Structure for the Research Library

How can program planning for the research library be linked to program planning for the university as a whole? Without program planning for the university, it is difficult to see how comprehensive program planning can be done for the university research library. Knowing how inadequate program planning is in most universities at present, it may well be that the research library will have to take initiative to invoke university program planning, just as physical facilities planners are forced to root out the academic expectations (unarticulated plans) of the institution to secure long-range decisions for site planning and building programming. I suspect that the research library can do a more effective, in-depth job of internal program planning than the university as a whole, because of the more concentrated purposes, the more coherent organization, and the relatively smaller scale of the research library.

The demands for services placed on the research library by its users, primarily faculty and students, are determined by the composition of the academic program and the magnitude of users' demand. In response to these demands the library is expected (1) to supply bibliographic materials that are relevant to the research, instruction, and service activities within the academic disciplines; (2) supply user services such as identifying bibliographic sources, locating, retrieving, and reproduction; (3) supply user space and any necessary equipment for using the library materials.

These services, I should think, constitute the basic programs of the research library. Let me suggest for the sake of discussion that the program elements of the research library might be defined as organizational units of library services, categories of the collections, and categories of user facilities. (See Figure B.) To test the linkage of the library program elements to the basic programs of the university, the following kind of grouping might be useful:

INSTRUCTION PROGRAM DEMANDS create needs for:

Undergraduate collections
Discipline collections
Reserve services
Reference services
Circulation services, etc.

Undergraduate reader facilities

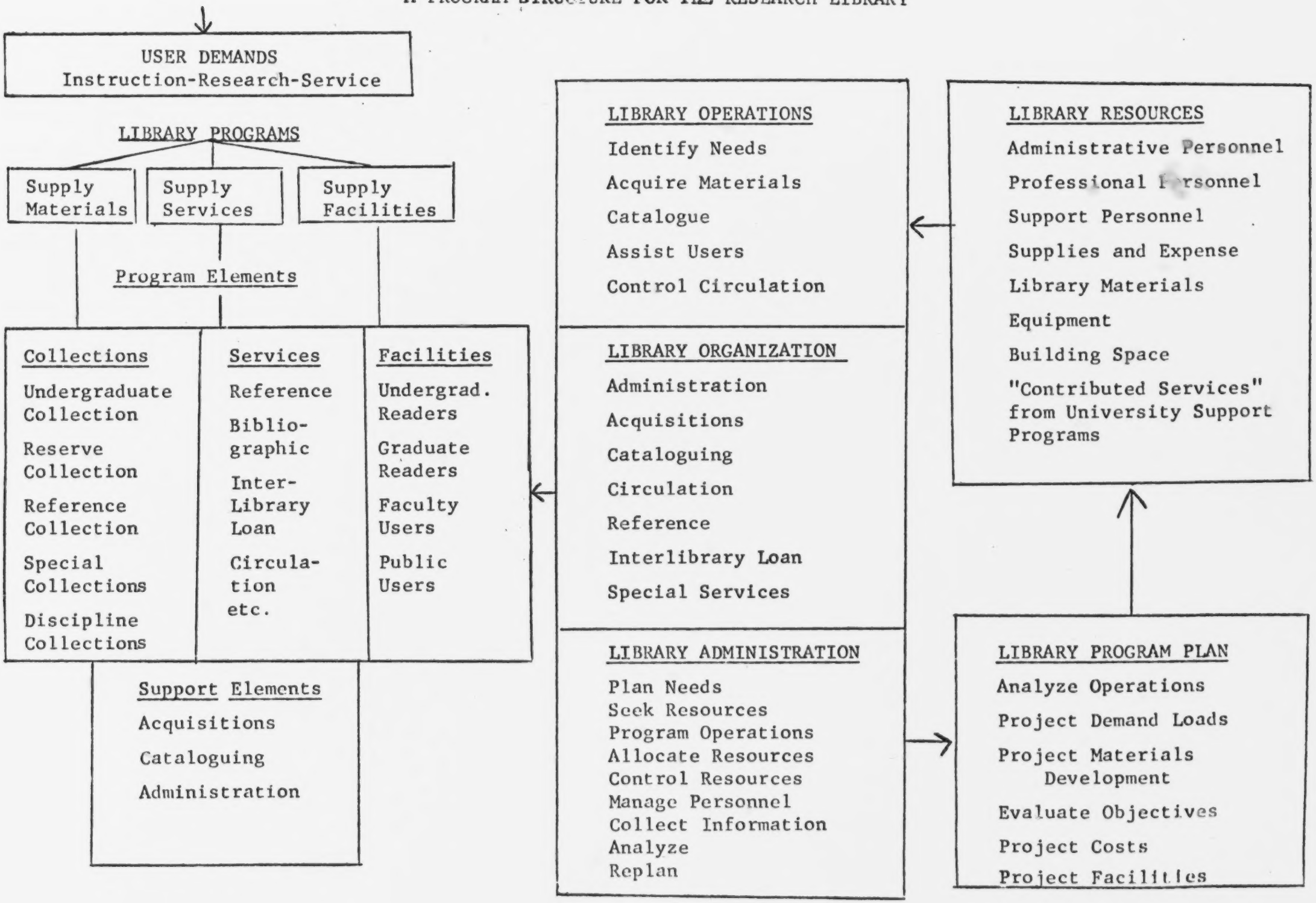
RESEARCH PROGRAM DEMANDS create needs for:

Special collections
Discipline collections
Bibliographic services
Interlibrary loan
Circulation Services, etc.

Graduate reader facilities
Faculty studies

FIGURE B

A PROGRAM STRUCTURE FOR THE RESEARCH LIBRARY



SERVICE PROGRAM DEMANDS create needs for:

Discipline collections
Extension collections
  Bibliographic services
  Interlibrary loan, etc.

Public user facilities

In addition, LIBRARY SUPPORTING PROGRAMS are needed to provide these services:

Administration
Acquisitions
Cataloging
Reproduction services, etc.

Each of the basic university programs may be viewed as placing demand burdens of various kinds and degrees on the library program elements. In planning for the library, the resource requirements for its program elements may be predicted from the data which describe the composition and quantities of demand for library services that will be generated by the instruction, research, and service programs.

Let me illustrate the kinds of factors that might provide measures of potential demand from the university programs. Many institutions are now projecting these kinds of factors as part of their planning process.

From the instructional program, we are projecting course enrollments and numbers of majors by level of student, level of course, and subject field. Say, for Projection Year Five, we are estimating 10,000 undergraduate course enrollments in the various fields of the humanities, 7,000 in the social sciences and so on. We also can tell you that we expect 1,000 undergraduate majors in the humanities and 1,300 in the social sciences. These factors will simply tell you what distribution of load is expected in the undergraduate instructional program.

The next step would be to develop, through research, some reasonable estimating factors to convert these projected instructional loads into loads on the various library program elements. Each discipline group probably would require a different set of factors reflecting different use of the library. For example, we might find from current and historic data that the humanities generate 35.5 reserve check-outs per week per 1,000 course enrollments at the undergraduate level but the physical sciences generate only 15.5 reserve check-outs per week per 1,000 course enrollments. We may also find that the reserve check-outs in the humanities are significantly longer in duration than in the physical sciences, and our projection factors may be adjusted accordingly.

These are, of course, artificial and perhaps absurd examples, but they illustrate the kinds of analyses that need to be made to develop program planning estimating factors. I suspect that there is a good deal of existing information that would provide some good estimating factors for a variety of kinds of loads. I also know that for some activities it will be extremely

difficult to work out estimating factors that reasonable men, accustomed to approximation can agree upon.

If you can set up a crude model of what you want to analyze, you can find already at hand much information to supply good first approximations. You also can identify the kinds of things that merit in-depth study. And as the model improves with experimentation, you know what kinds of information to start collecting to fill out the serious gaps or to replace crude rule-of-thumb factors or guesses with more accurate and informed values.

One of the most fascinating problems I can imagine would be to try to find some significant relationships between the composition of library collections and acquisition rates in various disciplines in relation to the changing composition of the academic disciplines in the university. I am well aware of the problems faced by library acquisitions when the university sets up a completely new field, such as a department of linguistics chaired by a leading authority in Sanskrit, with very little available in that field in existing library resources. A coordination of program planning of the university and the program planning of the research library in terms of acquisition objectives would be an excellent device for analyzing the projected content of the academic program in relation to the library resources needed to support it.[9]

All I have done is to illustrate the potential structure of program planning for a research library in a university setting. The program planning of a university must center on the development of instruction, research, and service programs as represented in the composition of specialized academic and professional disciplines. The programs of the research library are to provide services, materials, and facilities in response to the demands created by the students and faculty working within these disciplines. This interlocking of the functions of the research library with the functions of the university suggests that the planning of the research library may be an effective starting point for the more comprehensive program planning of the university.

As a matter of fact, both at the University of Colorado and at the University of Rochester, at the outset of concerted master planning efforts, the first priority was to plan the expansion of the university library. In both cases, the detailed work on library planning was instrumental in defining the basic planning assumptions of the university as a whole. This experience leads me to conclude that as we move toward further strengthening of the planning process in higher education, we could do well to begin with the research library.

We are now on the threshold of major advances in planning technique. Effective program planning is an essential to higher education. The old rules-of-thumb, the hallowed words of experienced authority, the casual, ad hoc response to short-range necessity, are no longer adequate to justify the resource needs and to order the management of our complex organizations.

In view of the identity of purpose between the university and the research library, the development of systematic, comprehensive program planning must proceed hand-in-hand. As a participant in the university planning process, I anticipate learning a great deal from the progress of the

Association of Research Libraries in promoting the development of more effective library planning and management systems. If my past experience is indicative, the university can learn much from the leadership of its librarians.

FOOTNOTES

1. See David Novick, ed., Program Budgeting: Program Analysis and the Federal Budget (Cambridge, Mass.: Harvard University Press, 1965); Harry Williams Planning for Effective Resource Allocation in Universities (Washington: American Council on Education 1966); and the Symposium on Planning-Programming-Budgeting, Public Administration Review, 26:4 (December, 1966). For an excellent, concise summary of the trends in management science which are behind the PPBS Approach, see F. deP. Hanika, New Thinking in Management: A Guide for Managers, (London: Hutchinson & Co., 1965).

2. Western Interstate Commission on Higher Education, "Proposal...for...a Regional Cooperative Project Among Higher Education Institutions and Coordinating Agencies to Design, Develop and Implement Information Systems and Data Bases Including Common Uniform Data Elements," (Boulder, Colo., WICHE, April 17, 1966). See also Ronald W. Brady and George W. Baughman, University Program Budgeting (Columbus, O.: The Ohio State University, June 13, 1968).

3. Western Interstate Commission on Higher Education, op. cit., pp. 14-18.

4. Williams, op. cit., esp. pp. 31-39.

5. Charles J. Hitch, "What are the Programs in Program Budgeting for Education?", Proceedings of the Symposium on Operations Analysis in Education, U. S. Office of Education, November 21, 1967 (publication forthcoming under the editorship of David S. Stoller and William Dorfman as a special issue of the Journal of Socio-Economic Planning Sciences.)

6. Aaron Wildavsky, "The Political Economy of Efficiency: Cost-Benefit Analysis, Systems Analysis, and Program Budgeting," in the Public Administration Review, cited note 1, p. 298.

7. Hitch, op. cit., (p. 1 of original mimeo copy).

8. Wildavsky, op. cit., pp. 302-307.

9. Since this paper was written a significant new book has been published dealing with these kinds of problems. It is Philip M. Morse, Library Effectiveness: A Systems Approach (Cambridge, Mass.: MIT Press, 1969). According to the Chronicle of Higher Education (1/13/69), this is "An experimental attempt to apply systems analysis to the operating problems of the library, focusing on the pattern of book use, its change over time, and the problems of how well the library satisfies its users."